tant at all points from a certain line supposed straight, but will return to it later. "But any one can see that herein is occasion for subjecting to a rigorous examination the very first principles of universal geometry."

This is Saccheri's excuse, his plea, his defense for introducing a new kind of geometry.

"Atque hinc incipit diuturnum praelium adversus hypothesin anguli acuti."

ARITHMETIC.

Conducted by B. F. FINKEL, Kidder, Mo. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

13. Proposed by J. R. BALDWIN, A. M., Professor of Mathematics in the Davenport Business College, Davenport, Iowa.

A man borrowed \$5000 at a western bank giving his note for \$5000 due in 5 years without grace at 8% interest payable annually, and pays the banker a bonus of \$500 in cash for making the loan; what rate per cent. does he pay?

I. Solution by ROBERT J. ALEY, A. M., Professor of Mathematics in the Indiana University, Bloomington, Indiana.

Simple interest on \$5000 for 5 years at 8% is \$2000.

If the interest is paid annually in advance, the loss of the use of the money to the borrower is the interest on \$400 for (5+4+3+2+1) years which is \$480. If the interest is paid annually but not in advance the loss is the interest on \$400 for (4+3+2+1) years which is \$320. Hence the total interest paid is

$$\$2000+\$500+\$480=\$2980$$
$$\text{or } \$2000+\$500+\$320=\$2820.$$

Interest for 1 year is $\frac{1}{5}$ of \$2980=\$596, or $\frac{1}{5}$ of \$2820=\$564.

$$\$596\div\$5000=11.92\%$$
$$\$564\div\$5000=11.28\%.$$

II. Solution by FRANK HORN, Kidder Institute, Kidder, Missouri.

II.
1. $100\%=\$5000=$face of note.
2. $1\%=\$50$.
3. $8\%=8\times\$50=\$400=$interest for 1 year.
4. $5\times\$400=\$2000=$interest for 5 years.
5. $\$2500=\$2000+\$500=$interest paid including the bonus.
6. $\$4500=\$5000-\$500=$amount the borrower kept.
7. $\therefore$ \$2500=the interest on \$4500 for 5 years.
8. $\$500=\frac{1}{5}$ of \$2500=the interest for 1 year.
9. $\$4500=100\%$ of itself.
10. $\$1=\frac{1}{45}\%$.
11. $\$500=500\times\frac{1}{45}\%=11\frac{1}{9}\%$.

III. $\therefore 11\frac{1}{9}\%$=rate of interest paid.

Solved with varying results by *M. A. Gruber*, *G. B. M Zeer*, *I. R. Baldwin*, *H C. Whitaker*, *H. W. Draughon*, *I. L. Beverage*, and *W. F. Bradbury*. Some of the contributors used compound interest.

14. Proposed by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

A bank by discounting a note of 7% receives for its money a discount equivalent to $7\frac{3}{4}\%$ interest. How long must the note have been discounted before it was due?

Solution by the Proposer.

$7\frac{3}{4}\%-7\%=\frac{3}{4}\%$. $7\frac{3}{4}:\frac{3}{4}=\$1.00:\$\frac{3}{31}$, the interest of \$1.00 for the required time at 7%.

$\$\frac{7}{100}:\$\frac{3}{31}=12$ months, : $16\frac{128}{217}$ months.

$\therefore$ Time$=16\frac{128}{217}$ months=1 year 4 month $17\frac{51}{217}$ days.

Also solved with different results by *H. C. Whitaker* and *P. S. Berg*.

15. Proposed by O. S. KIBLER, Superintendent of Schools, West Middleburg, Logan County, Ohio.

Supposing the town A to be 30 mi. from B, B 25 mi. from C, C 20 mi. from A, where must a house be erected to be equally distant from each of the towns?

Solution by W. A. GRUBER, War Department, Washington, D. C.

The radius of the circumscribed circle of the triangle formed by drawing AB, BC, and AC, is the *distance* required, and the center of this circle is the *place* for the erection of the house.

From Geometry or Trigonometry, we get

$$R=\frac{abc}{4\sqrt{s(s-a)(s-b)(s-c)}},$$

in which R represents radius of circumscribed circie of a triangle in terms of the sides of triangle.

Substituting for a, b, c, and s $[=\frac{1}{2}(a+b+c)]$, the respective values 25, 20, 30, and $37\frac{1}{2}$, we have

$$R=\frac{25\times20\times30}{4\sqrt{37\frac{1}{2}\times12\frac{1}{2}\times17\frac{1}{2}\times7\frac{1}{2}}}, \text{ which reduced, becomes}$$

$$R=\frac{40}{\sqrt{7}}=\frac{40\sqrt{7}}{7}=15.11857 \text{ mi.}$$

Also solved by *H. C. Whitaker*, *G. B. M. Zerr*, *Seth Pratt*, *J. F. W. Scheffer*, *J. W. Watson*, and *P. S. Berg*.

PROBLEMS.

22. Proposed by E. S. Loomis, A. M., Ph.D., Professor of Mathematics, Baldwin University, Berea, Ohio.

A borrows \$1000 from B for 10 years, on which he pays 4% semi-annually.

A immediately loans the \$1000 to C for 10 years, who agrees to pay to A \$12½ on the first of each month for 120 mos. or 10 yrs., at which time the whole debt is considered canceled, C no longer being, in any way, indebted to A. Upon the receipt of each of the \$12½ payments made by C, A immediately reloans it to D, E, F, etc., upon the same conditions as he loaned the \$1000 to C; at the end of 120 mos. all who are indebted to A pay up in full all due him, and he (A) pays B the principal, all interst having been paid when due.

Query: How many dollars has he in hand?